SIEMENS STEM DAY | Science Technology Engineering Math

SIEMENS STEM DAY ACTIVITY

THIS IS HOW I SE IT

REAL-WORLD SCIENCE TOPICS

- The orbits of the Earth around the Sun and the Moon around the Earth cause observable patterns.

ADDRESSES NGSS

LEVEL OF DIFFICULTY

3

GRADE RANGE

3–5

OVERVIEW

In this activity, students will construct interactive lunar cycle models to illustrate the phases of the Moon in 3 dimensions. They will demonstrate how the orientation of the Sun, Moon and Earth at certain points in the lunar cycle causes the phases as observed from Earth.

TOPIC

Lunar cycle

OBJECTIVE

After completing this activity, the student will be able to explain moon phases as they relate to the orbit of the Moon around the Earth and the Earth around the Sun.

NGSS THREE-DIMENSIONS

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. Develop and/or use models to describe and/or predict phenomena.	**5-ESS1.B: Earth and the Solar System** The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.	**Patterns** Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rate of change for natural phenomena. Patterns can be used as evidence to support an explanation. **Cause and Effect** Events that occur together with regularity might or might not be a cause and effect relationship.
Developing and Using Models Develop and/or use a model to predict and/or describe phenomena. Develop a model to describe unobservable mechanisms.	**MS-ESS1.A: The Universe & Its Stars** Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.	**Patterns** Patterns in rates of change and other numerical relation- ships can provide information about natural and human designed systems. Patterns can be used to identify cause and effect relationships.
		Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems. **Systems and System Models** Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. Models are limited in that they only represent certain aspects of the system under study.

BACKGROUND INFORMATION

What is the lunar cycle?

The lunar cycle is the appearance of the Moon as observed from Earth, as the Moon revolves or orbits the Earth about once every 27 days. Because the Earth is moving around the Sun, the Moon requires about 29.5 days to complete its full cycle and all phases. In other words, there are about 29.5 days from one new moon to the next.

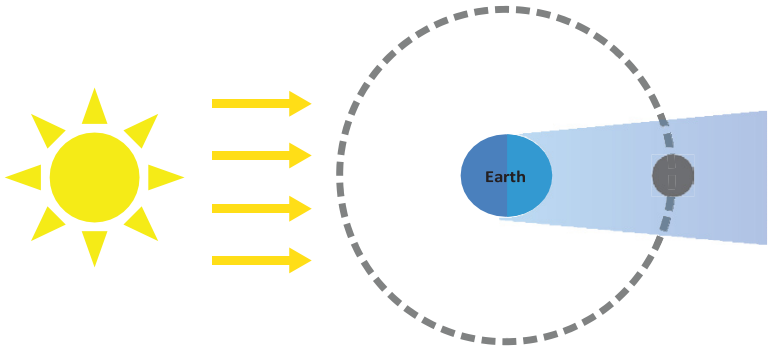
What causes the phases of the Moon?

The moon phases are the result of viewing the sunlit half of the Moon from the perspective of Earth. To understand the phases, one must understand that the half of the lunar surface facing the Sun is always lit. However, the portion of the sunlit side that can be seen by an observer from Earth changes as the Moon revolves (orbits) the Earth. Sometimes we can see all of the sunlit side of the Moon (full moon) and sometimes we cannot see any of the sunlit side (new moon).

What are the phases of the Moon?

New moon: none of the sunlit side can be seen during this phase
Waxing crescent: during this phase the sunlit portion of the Moon that can be seen is growing (waxing)
First quarter moon: at this point in the lunar cycle the Moon has moved a quarter of the way around its orbit of the Earth and the sunlit portion that can be seen from Earth is exactly half
Waxing gibbous: during this phase the sunlit portion of the Moon that can be seen is over half (gibbous) and growing (waxing)
Full moon: at this point in the cycle the entire sunlit side of the Moon can be seen
Waning gibbous: during this phase the sunlit portion of the Moon that can be seen is now shrinking (waning)
Third quarter moon: the Moon has moved three quarters of the way around its orbit of the Earth and exactly half of the sunlit side can be seen from Earth
Waning crescent: during this phase the sunlit portion of the Moon that can be seen is less than half (crescent) and continues to shrink (waning)

If the Earth is between the Sun and the Moon during the full moon phase (as seen below), why does the Earth not cast a shadow on the Moon?



Some 2-D drawings, like the one shown above, would make you think that is would be true. If this were the case, there would be a lunar eclipse every lunar cycle, which is not the case. The reason is that the lunar orbital plane is at a 5-degree angle from that of the ecliptic plane. See the 3-D images as http://www.hermit.org/eclipse/why_cycles.html for a better understanding of this concept. The models that will be built during this activity show this 5-degree tilt of the lunar orbit. Note: For the purpose of this activity, the ecliptic plane is parallel with the floor.

KEY VOCABULARY

Lunar Cycle
Orbit Revolve
Rotation
Crescent
Gibbous
Waxing
Waning

MATERIALS NEEDED FOR STUDENT ACTIVITY

- 8 Styrofoam balls (6") or other paintable balls that are approximately 6" in diameter
- 8 rolls of masking tape
- 27' (8 meters) of PVC pipe or sturdy wrapping paper tubes (Note: *If PVC pipe and cardboard tubes are not accessible, rolled poster board can be used. Instructions are provided for either option*.)
- Black water-based craft paint such as acrylic paint
- Blank copy paper
- Black and yellow colored pencils
- 8 meter sticks

TEACHER PREPARATION

- Print and copy the student handout. (1 per student)
- Print instruction page for each of the 8 stations.
- Paint each of the Styrofoam balls half black using water-based craft paint. It is important the black paint is on exactly half of the ball. This can be done by marking a line around the center of the ball using a marker and then painting on one side of the line with black paint. Push toothpicks into the ball to help hold it as you paint. If you have plenty of paint, dipping half of the ball in a large bowl of black paint may be quicker.
- You will need to prepare 8 tube stands that are the following heights: 1–.5 meter piece (station 1)
    - 2–.75 meters pieces (stations 2 and 8)
    - 2–1.0 meters (stations 3 and 7)
    - 2–1.25 meters pieces (stations 4 and 6)
    - 1–1.5 meters piece (station 5)

    Below are two options for constructing these tube stands.

    Option 1: PVC or cardboard tubes

    Cut the pipe or cardboard tubes into the lengths outlined above. To make the longer tube stands from cardboard tubes, insert one tube inside the end of a second tube and adjusted up or down to the correct length. Make sure to tape them so that is does not move up or down. If you cannot get one to fit inside another, tape them together and trim to the correct length. The pieces of pipe/tube will need to stand up on their ends so it is important that they get cut straight across at each end.

Option 2: Rolled poster board

Poster board vary in size, so general instruction are given here to help you construct the tubes listed above. No matter what the dimensions of your poster board are, it will need to either be trimmed to make the shorter tubes or stacked together to make the taller tube stands. For the tubes shorter than your poster board's width, trim down to the length needed and roll the board into a tube. Tape along the seam so it does not unroll. For the tubes longer than the board's width, roll two tubes and insert one into the other. Adjust the inserted tube up or down to make the tube the desired length. Tape the two rolled boards together and at the seams so that they do not unroll or move up or down. If your poster board is small, you may have to use three rolled boards to make the longest tubes. It is important that the tubes you construct stand up on at least one of their ends. This means that at least one end of the rolled tubes is level and will set evenly on the floor.

- Set up the 8 stations. Each station will need the following supplies:

Roll of masking tape
Meter stick
1 tube stand (see note on #4 for tube length and station #)
1 or 2 sheets of blank copy paper
Painted Styrofoam ball
Corresponding instruction sheet

1. **Warm-up Activity:** Use three student volunteers to quickly construct a human model showing the Earth's orbit around the Moon and the Moon's orbit around the Earth. Explain that one person represents the Sun, one the Moon and the other the Earth. The model should show the rotation of the Sun, Moon and Earth on their axes as well as the revelation of the Earth around the Sun and the Moon around the Earth.
2. Show the first 4 segments of the e-learningforkids.org Lunar Cycle video animation at https://lessons.e-learningforkids.org/efk/Courses/EN/S0801/login.htm (about 2 minutes in length). Do not show the fifth segment, as it will be used in the wrap-up activity.
3. Before moving to the next step, it is important to designate one wall as the "Sun." Using a Styrofoam ball from one of the stations, demonstrate that the half of the Moon facing that designated wall (the Sun) will always be lit by the Sun and the other half will always be dark or shadowed. Make sure student understand that no matter where the ball is in the room, the side facing the wall is always sunlit.
4. Explain to students that they are going to set up a model demonstrating one of the 8 phases in the lunar cycle. Let students know that to complete this task they will be given a meter stick, a roll of masking tape, a piece of pipe/tube, a Styrofoam ball that is half black and half white and an instruction sheet.
5. Number students off 1 through 8 and ask them to move to their corresponding station that you have prepared with materials prior to class. Explain that each station represents a different moon phase. Let students know they have 10 to 15 minutes to set up their model and complete the tasks outlined on the information sheet included with their materials.
6. Allow time for the groups to construct their model and complete the tasks assigned on the information sheet.

7. After 10 to 15 minutes, ask students to leave their model set up and rotate to the next station. As groups rotate through the stations, each student should step into the middle of the model and make observations about what the Moon looks like during that particular phase of the lunar cycle. The data table should be completed based on their observations at each station. Allow students several minutes at each station to complete this step.

   Wrap-up Activity: Show the fifth segment of the e-learningforkids.org video. Allow students to individually answer the remaining questions on their handout. Discuss as a class the answers to questions 6 and 7. Make sure students understand that the orbit of the Moon is tilted about 5 degrees from the plane of the Earth's orbit. This is why the Earth does not cast a shadow on the Moon (also known as a lunar eclipse) during its full moon phase. Allow students to ask questions for clarification.

6TH GRADE EXTENSION ACTIVITY

Have students make a small pocket size booklet that has 15 pages. Title the first page "My Moon Phase Observation Book." Label the following pages "Day 1" through "Day 29" (using both the front and back of the 15 pages.) Challenge students to find the Moon on each of the 29 days, draw what it looks like and record what time they made their observations. Ask them to label each of the 8 phases throughout the book. It may be helpful to have them start on the day of a new moon. Remind students that on some days the Moon is seen during the day rather than at night but that they can still make observations and complete their drawings.

SOURCES

Next Generation Science Standards
http://www.nextgenscience.org/

Lunar cycle animation
http://e-learningforkids.org/

NASA's 2013 phases of the Moon animation
http://www.nasa.gov/mission_pages/LRO/news/2013-moon-phases.html

General information about the movement of the Earth, Moon and Sun
http://www.hermit.org/eclipse/why_solsys.html

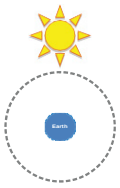
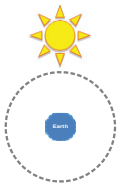
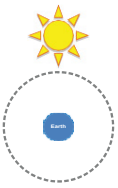
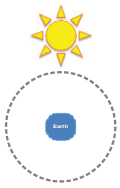
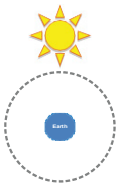
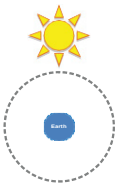
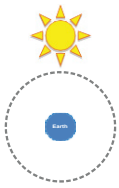
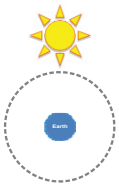
Lunar eclipse information
http://www.hermit.org/eclipse/why_cycles.html

How much of the Moon is lit at all times?

THIS IS HOW I SEE IT

What causes this to be the case?

Data Collection:

	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8
Phase Name								
Drawing of the Moon phase as viewed from Earth at each station.								
The dotted line represents the obit of the Moon around the Earth (center circle). Draw a black dot to represent where the Moon is on that orbit								
Height of pipe (meters)								
What percent of the Moon's lit side can be seen?								
What percent of the Moon's lit side can be seen?								

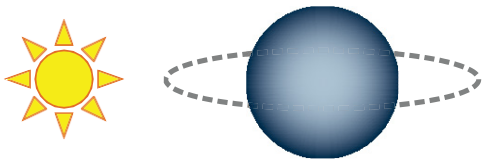
What percent of the Moon's dark (shadowed) side can be seen?

How long does it take the Moon to make an orbit around the Earth?

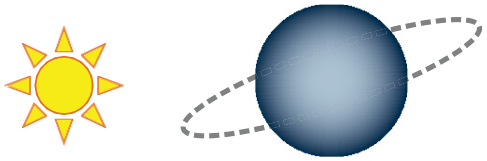
If you could stand on the Sun and view the Moon as it revolves around the Earth, would it have phases similar to the ones you see from Earth? Explain why or why not.

Which of these drawings of the Moon's orbit is most accurate?

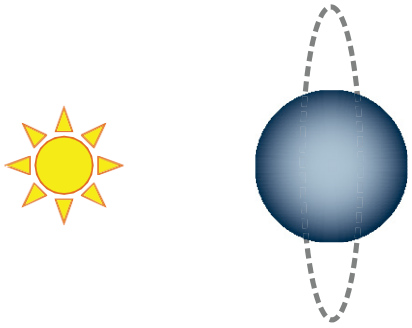
a.



b.



c.



Why are the pipes/tubes different lengths?

Why does the Earth not cast a shadow on the Moon during its full moon phase?

Name_____ Date_____ **TEACHER KEY**

THIS IS HOW I SEE IT

How much of the Moon is lit at all times?
Half of the moon is always sunlit.

What causes this to be the case?
One side of the moon is always facing the Sun and is therefore lit by the Sun's light.

Data Collection:

Phase Name	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8
	New Moon	**Waxing Crescent**	**First Quarter**	**Waxing Gibbous**	**Full Moon**	**Waning Gibbous**	**Third Quarter**	**Waning Crescent**
Drawing of the Moon phase as viewed from Earth at each station.	**Reference images at** http://lunar.arc.nasa.gov/science/phases.htm							
The dotted line represents the obit of the Moon around the Earth (center circle). Draw a black dot to represent where the Moon is on that orbit								
Height of pipe (meters)	**.5**	**.75**	**1**	**1.25**	**1.5**	**1.25**	**1**	**.75**
What percent of the Moon's lit side can be seen?	**0%**	**25%**	**50%**	**75%**	**100%**	**75%**	**50%**	**25%**
What percent of the Moon's lit side can be seen?	**100%**	**75%**	**50%**	**25%**	**0%**	**25%**	**50%**	**75%**

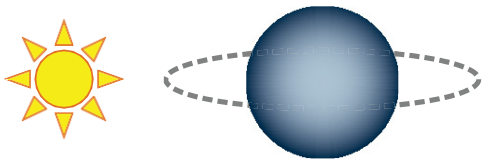
THIS IS HOW I SEE IT

How long does it take the Moon to make an orbit around the Earth?
27 days but because Earth is moving around its orbit of the Sun at the same, it takes 29.5 days for the Moon to complete it's phases or cycle.

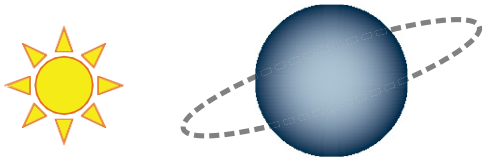
If you could stand on the Sun and view the Moon as it revolves around the Earth, would it have phases similar to the ones you see from Earth? Explain why or why not.
No there would be no phases because you would constantly be viewing the sunlit side of the moon. It would be a full moon all of the time.

Which of these drawings of the Moon's orbit is most accurate?

a.

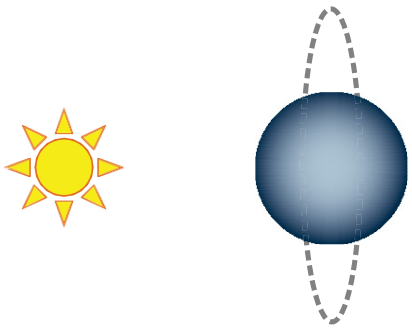


b.



B is correct because it shows the correct tilt in the Moon's orbital plane.

c.



Why are the pipes/tubes different lengths?
This allows the model to accurately demonstrate the 5-degree tilt in the orbital plan.

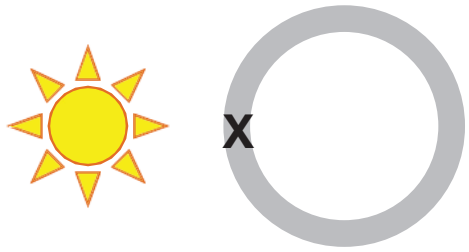
Why does the Earth not cast a shadow on the Moon during its full moon phase?
The orbit of the Moon is inclined 5-degrees from the Earth's orbit around the sun, and therefore the Earth does not block the Sun's light except for on rare occasion. This occasion is called a lunar eclipse.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. See the diagram below for help.



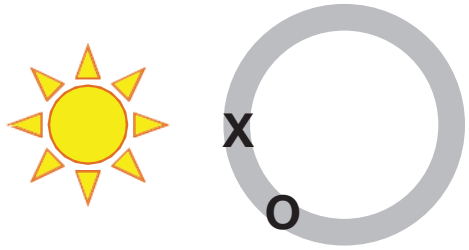
5. Set the piece of pipe/tube up directly on the "X".
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"New Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 1" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move on the circle counterclockwise 1/8 of the way around and draw a circle. See the diagram below for help.



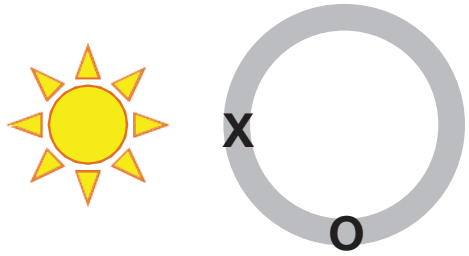
5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Waxing Crescent Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 2" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move counter-clockwise a quarter of the way around the circle and draw a circle. See the diagram below for help.



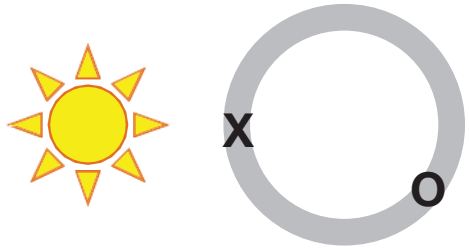
5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"First Quarter Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 3" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move counter-clockwise 3/8 of the way around the circle and draw a circle. See the diagram below for help.



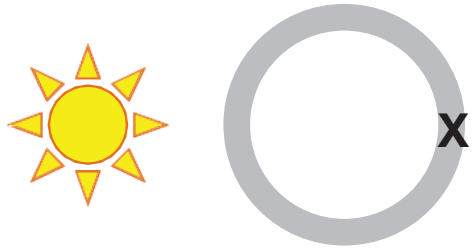
5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Waxing Gibbous Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1 meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 4" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is furthest from the Sun. See the diagram below for help.



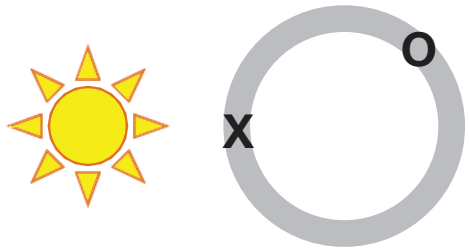
5. Set the piece of pipe/tube up directly on the "X".
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Full Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 5" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move counter- clockwise 5/8 of the way around the circle and draw a circle. See the diagram below for help.



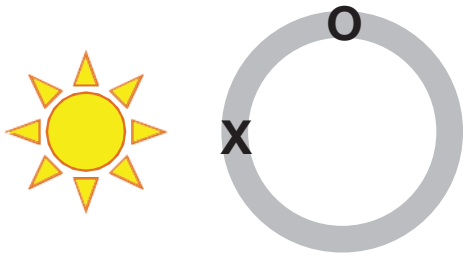
5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Waning Gibbous Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 6" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move counter- clockwise three quarters of the way around the circle and draw a circle. See the diagram below for help.



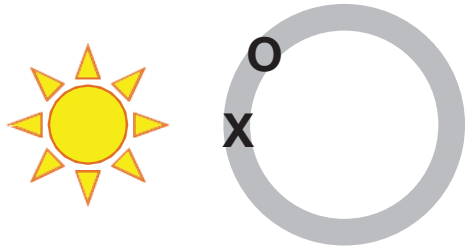
5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Third Quarter Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 7" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.

ELEMENTS OF MODEL

Earth: Your head
Sun: One wall in the room as designated by your teacher
Moon: Styrofoam ball that is half black and half white
Shape of Moon's orbit: Masking tape on floor

STEPS

1. As a group, answer questions 1 and 2 on the student handout.
2. Quickly tape a circle on the floor using masking tape. This circle should have a diameter of 2 meters (or a radius of 1 meter). It does not have to be a perfect circle. This circle represents the orbit of the Moon around the Earth
3. Find the wall in the room that represents the Sun.
4. Use a pen or pencil to make an "X" at the point on the circle that is closest to the Sun. Move counter- clockwise 7/8 of the way around the circle and draw a circle. See the diagram below for help.



5. Set the piece of pipe/tube up directly on the circle.
6. Set the Moon on top of the pipe/tube. Remember that the lit side of the Moon must ALWAYS face the Sun (or the wall that represents the Sun).
7. Tape a sheet of paper to the pipe/tube that says *"Waning Crescent Moon"*
8. Ask the teacher to check your set up so far.
9. Taking turns, each person should step into the circle. Remember that your head represents Earth. You should stand directly in the middle of the circle with your eyes about 1meter from the ground. Sitting in a chair or kneeling on one knee will make this possible.
10. Observe the Moon as it looks from Earth (your head/eyes).
11. Based on your observation, fill in the "Station 8" column on data table found on the student handout. You should use a black and/or yellow colored pencil to draw the Moon.
12. Discuss with your group members how you think the Moon will appear at the next station and how tall the pipe/tube will be.
13. Continue filling in your data table at each station.